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2. Power Exchange with Neighboring Countries

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Rationing of Electrical Power in Poland

1. Before World War II, Poland had no integrated system of power lines. Each power plant or small group of plants served its own territory without connecting lines to other power-producing and consuming areas. The damage to power system facilities during World War II caused an extensive breakdown in the distribution system. After the war, a gradual recovery was brought about by repairing the damaged equipment. Soviet plans to make Poland an industrialized satellite required a country-wide network of high voltage transmission lines and a substantial increase in the generating capacity. However, the means of accomplishing this were not easily obtained. By 1947, a network began to appear and by June 1949, central dispatching of power was instituted. This was handicapped by lack of communications, telemetric, and telesignaling equipment as well as by very unreliable generating plants. A three-year plan (1947 to 1949) was mainly set up to accomplish the post war goal of power plant repair. This was followed by a six-year plan (1949 - 1955) with very ambitious goals of power plant construction. As difficulties in procurement of equipment arose, the plans were scaled down. By mid-1952, an immediate need existed for 300 mw. of generating capacity, and the total available was probably 600 mw. behind the planned installed capacity. The most critical shortages were in Upper Silesia and in the Lodz area. Since so few new plants had been installed, the bulk of the load depended on old plants, badly in need of replacement and repair.

2. When a generating unit had to be taken off the line, there was usually no standby capacity to call upon and part of the load had to be cut off. Since every industrial plant cut off ran into trouble in meeting its norms, a great deal of effort was

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exerted by plant personnel in attempting to have their plant exempt from the power shutoffs. As a result of this competition, a rigid system of priorities was established. Each month, a conference was held at the central dispatching office at the Ministry of Power in Warsaw to decide on the load to be assigned to each of the six districts. The pay of everyone in the entire power system depended on meeting this assigned load. When overloading threatened, or generating units were shut down, the district dispatchers were told how much they were to reduce their loads. They, in turn, informed local dispatch points how much to reduce their loads. These local dispatchers followed a chart for turning off branch circuits which were arranged so that certain high priority plants would not be affected. As a result, suburban residential districts and outlying towns as well as less important plants were subject to frequent and lengthy interruptions. In addition, periods of no current for residential areas were scheduled during peak periods. During the winter of 1952 - 1953, the suburban areas of Warsaw were without lights every evening for two months. In addition, a strict limit on total consumption and maximum rate were imposed on households, based on the number of rooms in the apartment. As a result, in the average home, no electric hot plates or refrigerators could be used and electric irons and lights were used only sparingly.

3. This serious shortage of power was due primarily to a lack of new generating equipment. Industry and demand for electricity had expanded faster than production facilities could be built. It was also aggravated by the following factors:

   a. Poor condition of old equipment.

   b. Poor power factor of connected load.

   c. Poor voltage and frequency regulation.

   d. Poor repair facilities.

   e. Lack of some transmission-line equipment which would allow higher voltages to be used.

   f. Use of low-grade coal.

4. The use of low-grade coal in power production was one of the most important problems and carefully controlled by the Exploitation Department of the Ministry of Power as well as by the PKPG, the State Commission for Economic Planning. All of the power plants 25X1 used less than five per cent of the coal produced in Poland; about 65 kg. of coal/kw. hour were used on the average, based on a heat content of 6,000 Kcal/kg. Yearly norms for output of power per pound of coal were established by the PKPG. The PKPG also established the norm for utilization of very low-grade fuel which consisted of coal dust and various mixtures of coal, dirt, clay, etc. These low-grade fuels probably constituted up to 20% of the fuel expended. The heat content of this low-grade coal should not exceed 3,500 calories/kg. In the winter, the handling of this low-grade fuel was very difficult since it contained a great deal of moisture which froze. For successful burning of this coal, workers received special pay, but they also lost much of this premium when it was necessary to clean the boilers frequently.

Power Factor Improvement

5. The power factor under which the system operated was very poor and there was little likelihood of improving it in the near future. The only synchronous condenser in Poland was a 10-mva unit located at Starachowice /N 51-09, E 20-33/. Eight or 10 such machines should

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be used to improve the power factor, and by 1960, several were planned. [redacted] 25X1
A number of static condensers were ordered [redacted] in 1951 to alleviate the conditions in the oil field area in the southeast corner of Poland where the load had a power factor of about 60. [redacted] No 25X1
suitable condenser factory existed in Poland, although one was planned, but size and location were unknown. [redacted] it would possibly be three years before it could be finished. Another factor contributing to the problem was the use of transformers that were too large for the load. Lack of available transformers limited the choice. An attempt to alleviate the power factor problem had been made by changing the wiring arrangement of large motors that were lightly loaded from delta to star, or by using motors more nearly suited to the load. This program was handicapped by a lack of measuring instruments to measure power factor, loads, etc. Plants were penalized for their poor power factor by high charges, but they were unable to take corrective measures because of a lack of equipment.

Voltage and Frequency Regulation

6. The voltages used on transmission lines were 110, 60, 40, 35, 30, 20, 15, 10, 6, and 2 kv. The Ministry of Power wanted to standardize 220, 110, 60, 30 and 15 kv. Use of 10, 20, 40 and 35 kv. will be discontinued during the period 1955 - 1960. Power was usually generated at five kilovolts and the system operated on 50 cps.

7. Because of the lack of standby generating equipment and the high demands made on the system, voltage and frequency regulation were poor. Especially poor was the voltage regulation in the 110 kv. net because of a shortage of regulating transformers. Some of the 15 MVA regulating transformers for 110/30 kv., variable under load, were ordered [redacted] in 1952. [redacted] 25X1 repair men came in 1952 to make adjustments or to repair the regulating features of these transformers, located near Roznow. A number of old regulating transformers were out of use for lack of repair.

8. To avoid poor frequency regulation caused by overload, 30 automatic protective switches were installed during the last year; these served to cut off loads of lesser importance when frequencies were below 49 cps. They have been used in lines of less than 60 kv and were developed by PPAE (Laboratory for Prototypes of Electrical Measuring Devices) in Warsaw.

9. A system of forced excitation of alternators was put in effect recently on the advice of Soviet experts. This system increased the excitation of the alternator in case of short circuits on lines and tended to prevent voltage drops. This method was used throughout the east section of the system including Roznow, Starachowice, and Stalowa Wola. The number of power failures was reduced after its inception. Its extension to the entire Polish system was under study. The persons who put this system into use were awarded the Polish State Prize in 1953.

Net Protecting Devices

10. After the war, a number, perhaps 20, of impedance relays Model L3WXS, were purchased [redacted] 25X1 to protect the most important substation points in the 110 kv. system. However, there was still a great lack of these relays.

11. The problem of protecting the planned 220 kv. net was still under discussion. Soviet experts gave their advice in general terms, but Polish engineers did not believe they had reliable answers since it was thought that they had little experience with 220 kv. Because of a lack of knowledge of foreign protecting equipment it had not been decided even in 1953 where it should be ordered.

12. There was very little selective protection equipment. Most of the old protective equipment was of German manufacture; however, the Stalowa [redacted] 25X1 25X1

13. The lower voltage lines were protected by very old-type overload relays. Often there were breakdowns of large areas of these lines caused by overworking these protective devices. The neutrals of the 110 kv. system were, in some areas, insulated and in others, grounded, thus causing difficulties in coordinating the protective devices. There was no section in the Energy Project Design Bureau that dealt specifically with this problem. Planning was made very difficult by a lack of consistency on the part of PKPG. Work was nearly complete on a study of short circuit currents, but only by a great deal of effort in overcoming those difficulties caused by the PKPG's constantly changing system specifications.

14. An automatic repeating switch, called SPZ (Samoczynne Powtorne Zalaczanie), was made available to Poland by the USSR. This device allowed a circuit to be reclosed automatically if the short or other difficulty causing a cutoff was only temporary. These were being hurriedly installed on lower voltage lines. About 100 had been installed on 30 kv. lines.

Power Exchange with Neighboring Countries

15. Power was exchanged with East Germany through a 100 kv. line from Hirschfelde, Germany to Boleslawiec in Poland. In the region of Zgorzelec, a 40 kv. line crossed the border and was tied in with the same local net. There were no telecommunications facilities in conjunction with those lines because of a reluctance on the part of security personnel to approve such lines. However, the question was discussed. The Polish Ministry of Power proposed a single side band carrier system for this link instead of the normal two band German system. No decision had been reached on the German side.

16. An old 100 kv. line (built before 1945) ran from the Victoria power plant at Walbrzych, Poland, to Porici in Czechoslovakia. A two side band carrier system operated on this line to provide control of energy exchange; it extended to Wroclaw (Breslau). The exchange of energy amounted to as much as 20 mw. in each direction but averaged out.

17. A new 220 line was planned from Jaworzno II power plant to some point in Czechoslovakia, and should be built during the next five-year plan starting in 1956. The reason for building this line was unknown to Source, but he was aware that the planning was surrounded with great secrecy.

18. The only power line crossing the border into the USSR was a 15 kv. wooden pole line somewhere in the Zamosc district. Approximately 200 kw. were sent into the USSR over this line. The Soviets wanted this raised to 500 kw. No telecommunications facilities existed in connection with this line, apparently for security reasons. The Polish Ministry once

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urged that such facilities be set up to avoid electrocution of Soviet linemen after repairs were completed, but nothing was done.

Planned and Recent Additions to the Power-Generating and Distribution System

19. The total production of electric energy in 1951 amounted to about six billion kwh's and in 1952 increased to about seven billion kwh's. In 1952, the usual summer decline in power consumption did not appear on the charts because of expanded industrial use. During the first three months of 1953, the maximum peak power was 2,000 mw., including power plants in factories contributing to the overall net, which amounted to about 600 mw. Since this was a new high, several dispatchers and power plant operators received bonuses of 500 to 1,000 zlotys. Efforts were also being made to reduce power losses from 13.5% in 1952 to 13.1% in 1953.

20. The plans of the present six-year plan call for an annual production by all generating power plants of 19 billion kwh's by 1955. This figure was mentioned as a goal in public displays of the Department of Plans and Statistics (Departament Planowania) at the Ministry of Power Plants in Warsaw in March 1953. The figure of 17 billion kwh. had been discussed for a time within the ministry but was raised to 19 billion this year. Source considered these goals extremely optimistic with very little chance of fulfillment because of the apparently insoluble difficulties in obtaining new equipment.

21. The following power plants had been built since the war or were being built or enlarged:

a. Nowa Huta /N 50-05, E 19-55/. This power plant of approximately 50 mw. was built presumably with Soviet equipment on a very high priority basis to serve as a power source at the Nowa Huta Steel Plant near Krakow. This steel plant, the greatest single investment of the six-year plan, was entirely of Soviet origin. [redacted] the power plant was under construction two years ago and [redacted] it would be put into operation this year. [redacted] 25X1

b. Miechowice (location unknown). This power plant had new equipment already generating about 30 mw., installed in 1952 in an old building. [redacted] the boilers probably came from Czechoslovakia. Difficulties were encountered with the boilers because of defects in their construction. This plant may be expanded to more than 100 mw. [redacted] 25X1

c. Czchow /N 49-05, E 20-41/. This was a new hydroelectric plant with one five megawatt [redacted] turbine and generator in operation since December 1951. There was room for a second five megawatt unit but no plans existed for its installation. 25X1

d. Dychow /N 51-58, E 15-05/. This was an old hydroelectric plant near the present German border which was dismantled by the Soviets after the war. When the need for power became urgent, the Soviets sold the original German equipment to the Polish Government and returned it in 1950. About three generating units were installed, producing about 50 mw. The relays from the USSR used at this plant did not work well. This plant had possibilities of expanding to approximately 100 mw.

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e. Stalowa Wola /N 50-34, E 22-03/. This plant, built by French constructors in 1938, was in the process of having a new turbine and several new boilers installed. The original equipment included two 20 mw. turbines which were able to put out a total of only 34 mw. because of the poor superheat section of the old boilers. In 1951, a new 35 mw. turbine to operate on 38 atmospheres pressure was received [redacted] New boilers to provide 25X1 steam for this turbine were being obtained from Czechoslovakia. This project had a high priority since the plant supplied power to the Stalowa Wola Steel Plant which worked on military projects.

f. Zeran /N 52-15, E 21-00/. This was a new thermal power plant being built near Warsaw to supplement the old plant which could not meet demands because of age and war damage. [redacted] 25X1 the walls of the new plant were being erected. Many Soviet experts were concerned with the design of this plant, [redacted] 25X1 the turbines may come from the USSR and some of the boilers from Czechoslovakia. A total installed capacity of about 200 mw. was planned.

g. Lublin /N 51-15, E 22-34/. This plant was built in 1927 and produced about 4.7 mw. This year, an additional turbine and boiler will be installed to add 10 mw. to the capacity. This turbine is an old one from Czestochowa /N 50-48, E 19-07/ which had been reconditioned.

h. Jaworzno II /N 50-13, E 19-17/. This new thermal power plant was the most important plant of the present six-year plan and will serve the highly industrialized area of Upper Silesia. The demand for power in this area had been growing greatly and the eastern district was becoming increasingly incapable of supplying power to this area because of its own increase in industrialization. The equipment for Jaworzno II came from the USSR. One unit of 50 mw. capacity had been operating since 1950 or 1951 and a similar unit was expected to be finished this year. A total of four units, with total output of 200 mw., was planned. The operating steam temperature was 500° C.

i. Ostroleka /N 53-05, E 21-34/. This was a new thermal power station that was being built from old equipment gathered from a great many sources in Poland, old German equipment, abandoned Polish plants, etc. A total of 100 mw. capacity was planned but many difficulties were being encountered because of the mismatched components. [redacted] it would be a year and a half before the first units were 25X1 finished. [redacted] an engineer named RZEPKIEWICZ, was the director of the power plant. [redacted]

j. Czechnica /N 51-06, E 17-02/ near Wroclaw (Breslau). This former German plant was dismantled by Soviets after the war. A new thermal power plant was being built in the old buildings under the direction of Ing. ZABOKRZYCKI [redacted] He was not a Party member. 25X1 Source estimated this would be a 100 mw. station and would be ready in about three years. [redacted]

k. Porabka /N 49-99, E 19-14/. This hydroelectric plant was being built. It was started in 1939, but the war interrupted construction when only the water course and turbine foundations were finished. [redacted] no 25X1 power was being generated yet. It was to be perhaps 50 mw. [redacted]

l. Starachowice /N 51-04, E 21-04/. This plant had a 7.5 mw. Ljungstrom turbine and new condensers installed [redacted] in 1952. 25X1 New powdered-coal boilers to operate at 35 atmospheres (of unknown origin) were also installed. The original capacity had been about 3.5 mw.

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m. Zabrze /N 50-19, E 18-47/. Two new high performance boilers were received from Czechoslovakia in 1951 and installed in 1952.

22. The following power plants were planned:

a. Konin /N 52-13, E 18-16/. This was to be a 200 mw. plant to burn lignite. It was being designed in Berlin and presumably would have the main components manufactured in East Germany. [redacted] It would help link the north-west power system with the central power system. 25X1

b. Bug I and Bug II. These two hydroelectric plants were to be built in the next five-year plan, 1956 - 1960, on the River Bug in conjunction with canals from the upper tributaries of the Prippet River in the USSR. They were to be designed and built by the Soviets. [redacted] 25X1

c. Stettin. Since a new smelting plant was planned for Stettin and the old power plant was in very bad condition, a new power plant of perhaps 150 to 200 mw. would probably be built.

23. The Main problem of power distribution was that of completing the planned 220 kv. circular net to connect power plants at Janow /N 50-44, E 19-27/, Szamoty /N 50-12, E 20-55/, Rozki /N 51-21, E 21-04/, Jaworzno II and Lagisza /N 50-13, E 19-17/. The section of the loop between Janow and Lagisza and between Jaworzno II and Rozki had been completed but was operating on 110 kv. until the 220 kv. equipment for the substations was installed. The 220 kv. lines from Janow to the Zachodnia substation of Warsaw and from Szamoty to Rozki were expected to be built in the years 1954 and 1955. The link between Lagisza and Jaworzno II will probably be built in 1957 - 1958. [redacted] 25X1

24. In addition to this 220 kv. loop, lines for this voltage were to be built from Janow to the planned power plant at Konin for 110 kv. and from Lagisza to Czechnica during the next five-year plan (1956 - 1960) for 220 kv. Another possible line was the one to Czechoslovakia mentioned in Paragraph V, C.

25. Intensive effort had been made to complete a 110 kv. loop from Lesniewo /N 54-21, E 18-40/ through Tczew /N 54-06, E 18-48/, Starogard /N 53-58, E 18-33/, Jasiniec /N 53-08, E 18-07/ to Pakosc /N 52-48, E 18-06/ to connect with Gniezno /N 52-33, E 17-36/, Pniewy /N 52-31, E 16-16/, Gorzow /N 51-02, E 18-26/, and Stargard /N 53-20, E 15-03/. This involved building lines from Stargard to Gorzow (1951) and raising the voltage of the section from Lesniewo through Tczew, Starogard, Jasiniec to Pakosc to 110 kv. This line was originally built for 110 kv. but had to operate on 60 kv. because of lack of transformers and other substation equipment. Other 110 kv. lines built since the war were as follows:

a. Dychow to Pniewy (1951).

b. Lebork /N 54-33, E 17-46/ to Gdynia /N 54-30, E 18-33/ built in 1949 for 110 kv. but operating on 60 kv.

c. Elblag /N 54-10, E 19-23/ to Olsztyn /N 53-47, E 20-29/ built in 1950, still operating on 60 kv.

d. Lublin to Stalowa Wola built in 1949.

e. Stalowa Wola to Boguchwala /N 49-59, E 21-57/ built in 1952.

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f. Boguchwala to Krosno /N 49-41, E 21-47/ built in 1952.

g. A branch line to Debica /N 50-03, E 21-25/ from the Tarnow-Boguchwala line, built in 1953 to increase the power delivered to the important factory development in Mielec /N 50-17, E 21-25/.

26. The following 110 kv. lines were planned or were under construction:

a. Dziwnow /N 53-37, E 18-54/ Nowograd (to be finished this year).

b. Debica to Mielec (to be finished this year).

c. Mielec to Stalowa Wola (1954).

d. Gniezno to Konin (1955 - 1960).

e. Olsztyn to Ostroleka (1955 - 1960).

f. Olsztyn to Warsaw (1955 - 1956).

g. Ostrolenka to Szamoty (1955).

h. Ostrolenka to Bialystok (1954).

27. In 1951, a power line to operate at 30 kv. was rushed to completion to supply power from the Sanok /N 49-34, E 22-12/ power plant to an oil producing area near Ustrzyki Dolne /N 49-24, E 22-36/ which had been ceded to Poland by the USSR in 1951 in a readjustment of the border. The Soviets had been using miscellaneous makeshift equipment including old tank engines for the production of power for this area, a system that was proving very unreliable and expensive. In 1952, a 15 kv. power line was extended to Czarna. In addition to this area, an oil producing area extended for about 120 km. along the base of the Carpathian Mountains. The load for this industry was about three megawatts in 1951 and should be about five megawatts by 1955. The line between Boguchwala and Krosne built in 1952, although designed for 110 kv. had been operating at 30 kv. It may be raised to 110 kv. next year. The construction of this line in 1952 helped relieve the poor voltage regulation which previously had been so bad that the line voltage often dropped from 30 kv. to 28 kv., sometimes reaching as low as 26 kv. An additional difficulty was the unreliability of relays and circuit breakers in the substation, which caused frequent breakdowns.

28. Construction of substations had kept pace with new transmission line construction. Difficulty had been encountered in obtaining transformers variable under load for the 110 kv. net. At Janow, new substation equipment for 220 v. was being installed. Four single phase transformers (one for reserve) from the Asea works in Vaesteras, Sweden, were installed this year. The last unit was completed by June 1953. These were ordered in 1948. Presumably similar equipment was being installed at Rozki, Jaworzno II, and Lagisza, the other substations of the 220 kv. net.

29. Plans for an underground control room and dispatching point: In event of war, an important problem would be to insure communications between the various distributing points. The first problem was to equip the underground room for PZDM (main dispatching point) in the Ministry of Power. This room was to be located beneath the Power Ministry building. In June 1953, the secret project of designing the consoles and other fixtures for this room was completed by Source's department. It was planned to use a short wave system, still to be constructed, in the event that normal systems of communications were disrupted during war. This system will not be used in peace time. In accordance with Soviet instructions, each of the larger power plants should be equipped with transmitting and receiving equipment to be used only in the event of war. 25X1

[redacted] this system was already in existence in the USSR. 25X1

30. Power supply for the aluminum industry in Poland: in the early part of 1952 [redacted] difficulty of power 25X1 interruption to a plant in Trzebinia /N 50-10, E 19-29/ which was carrying out initial tests on aluminum production. [redacted] 25X1 the Ministry of Heavy Industry said that such interruptions would not be tolerated as it caused enormous difficulties because the aluminum solidified in the cells. The plant used about three to four megawatts of power. [redacted] 25X1

Repair Facilities for Power Generation Equipment

31. The condition of turbines and especially of boilers in Poland was, in general, very bad. The lack of spare parts contributed greatly to the uncertainty of operation. Especially difficult to obtain were parts for turbine regulators. Many difficulties also occurred in repairing parts for the large transformer controls and circuit breakers. [redacted] 25X1 On rare occasions, some parts for the boilers were imported from Czechoslovakia. [redacted]

32. Repair facilities for power generating equipment were very limited in Poland. Boilers were usually repaired by various Polish enterprises. The quality of boilers received from Czechoslovakia had been very disappointing and numerous conferences had been held with Czech engineers to discuss the problem. Turbines that could not be repaired in the plant itself were sent to Elblag (Elbing), a former German turbine repair shop, where turbine blades were made. These blades, however, were of inferior quality. Work was very slow because of a lack of materials and properly qualified labor. Plans had been made to build 15 mw. turbines here starting in 1955. About 2,000 men were employed. Work for the Navy was also done.

33. Alternators larger than five megawatts and large transformers were usually sent to Dresden, Erfurt, or Berlin for major repairs. Transformers under 15 mva were repaired at Zychlin (Warsaw area) at an electrical repair shop built before the war. Transformers up to 15 mva were produced here.

34. Transmission line insulators were made in the Boguchwala porcelain plant. [redacted] 25X1

35. Because of the great pressure put on plant personnel to cut repair time to a minimum, repair men went into boilers when they had cooled to only 158° F. The average time for repair on a boiler was 21 days. A major repair on the turbine, including a partial changing of blades, took, on an average, about 14 days.

36. In June 1953 at Jaworzno II [redacted] an acoustic crack 25X1 detecting device made in Leningrad. [redacted] A frequency of 0.8 megacycles was to be used on steel and 2.5 megacycles on cast iron was used. The electronic parts including a cathode ray tube were in a box 18 x 30 x 18 in. The pickups and vibrating capsules were on four foot cords and were about four centimeters high by two centimeters in diameter. They had various shaped lower ends to facilitate application to various surface shapes. [redacted] 25X1 the equipment was not understood by the operator and that he did not want to tell everything.

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Repair of Power Generating Equipment in the East Zone of Germany 25X1

37. [redacted]

38. [redacted] the Klara Zetkin Repair Plant in Erfurt to [redacted] repair of two alternators, one of 40 mw. from the Victoria Power Plant at Walbrzych /N 50-46, E 16-17/ and one of 45 mw. from Chorzow (Koenigshuette) /N 50-18, E 18-58/. [redacted] The Klara Zetkin plant management complained of lack of skilled labor and materials, but finally agreed to finish one by 15 January 1954 and the other (from Victoria) by 15 February. These two items were the largest repair jobs in the plant. The next largest were about 10 mw. generators of which there were about five, in addition to many small electric motors. Of about 600 - 800 employees, approximately one-third were women. The men were mostly middle-aged, the women younger. The plant management seemed to consist of old master mechanics. The cost of the repairs of the Polish generators was set at 200,000 DM East.

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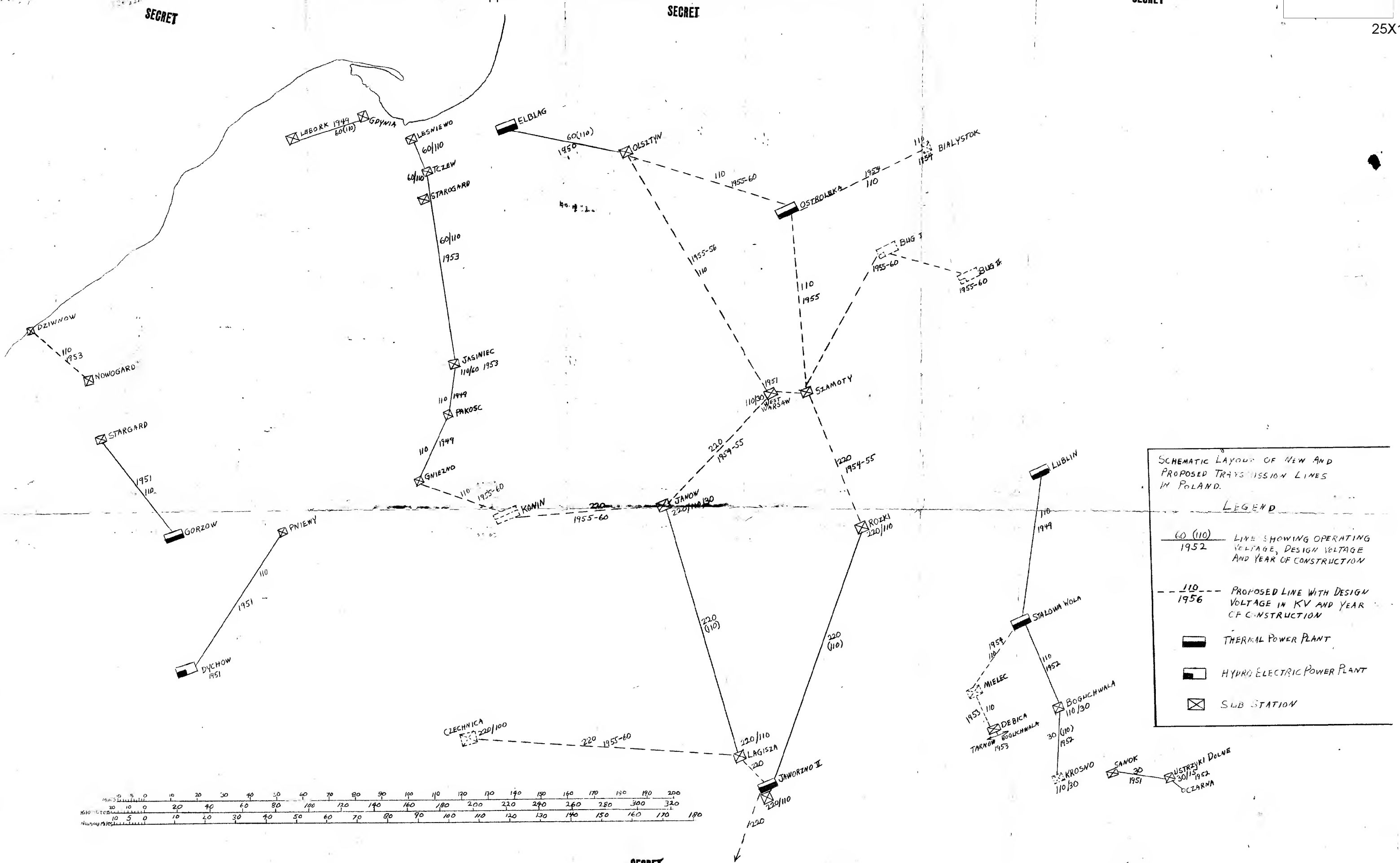

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